

## CLAIMS

I/We claim:

- [c1]            1.        A method for fastening components, comprising:  
inserting an elongated member through a first hole in a first component and  
a second hole in a second component, with a head of the elongated  
member positioned at least proximate to the first component;  
swaging a collar to a helical groove of the elongated member, with the first  
and second components positioned between the head and the  
collar, and with the collar positioned between the second component  
and a removable portion of the elongated member; and  
removing the removable portion of the elongated member.
- [c2]            2.        The method of claim 1 wherein removing the removable portion of  
the elongated member is performed during, after, or during and after swaging the  
collar.
- [c3]            3.        The method of claim 1 wherein inserting the elongated member  
through the first hole includes inserting the elongated member so that a first  
portion of the elongated member aligned with and received by the first hole has a  
diameter less than a diameter of the first hole, and wherein inserting the  
elongated member through the second hole includes inserting the elongated  
member so that a second portion of the elongated member aligned with and  
received by the second hole has a diameter less than a diameter of the second  
hole.
- [c4]            4.        The method of claim 1, further comprising applying a liquid to the  
elongated member before swaging the collar, and swaging the collar without  
removing the liquid.

- [c5]            5.        The method of claim 1 wherein swaging the collar and removing the removable portion of the elongated member include engaging the removable portion of the elongated member with a first portion of an installation tool, engaging the collar with a second portion of the installation tool, and moving at least one of the first portion and the second portion axially relative to the other.
- [c6]            6.        The method of claim 1 wherein inserting the elongated member includes inserting the elongated member through a first hole in a first composite aircraft component and inserting the elongated member through a second hole in a second composite aircraft component.
- [c7]            7.        The method of claim 1 wherein the elongated member is elongated along an axis and wherein removing the removable portion of the elongated member includes applying a force to the removable portion generally aligned with the axis.
- [c8]            8.        The method of claim 1 wherein inserting the elongated member includes inserting the elongated member to have an interference fit with at least one of the first hole of the first component and the second hole of the second component.
- [c9]            9.        The method of claim 1 wherein inserting the elongated member includes inserting the elongated member without a tool, and with the elongated member having a loose fit in the first and second holes.
- [c10]           10.       The method of claim 1 wherein inserting the elongated member includes inserting the elongated member with the head bearing against the first component.

- [c11] 11. The method of claim 1 wherein swaging the collar includes swaging the collar to bear against the second component.
- [c12] 12. The method of claim 1 wherein swaging the collar includes applying an axial force and a radially inwardly directed force to the collar, without applying a torque to the collar.
- [c13] 13. The method of claim 1, further comprising passing the collar axially over the helical groove without rotating either the collar or the elongated member, prior to swaging the collar.
- [c14] 14. A method for fastening components, comprising:  
inserting an elongated pin through a first hole in a first component and a second hole in a second component, with a head of the elongated pin positioned against the first component, the first hole having a first diameter greater than a diameter of a first portion of the elongated pin received in the first hole, the second hole having a second diameter greater than a diameter of a second portion of the elongated pin received in the second hole;  
applying a fluid to the elongated pin;  
swaging a collar to a helical groove of the elongated pin, with the collar positioned against the second component, and with the collar positioned between the second component and a third portion of the elongated pin;  
breaking a connection located between the third portion of the elongated pin and the second portion of the elongated pin; and  
removing the third portion of the pin.
- [c15] 15. The method of claim 14 wherein applying a fluid to the elongated pin includes applying a sealant.

- [c16]            16.    The method of claim 14 wherein swaging the collar includes swaging the collar without removing the fluid from the elongated pin.
- [c17]            17.    The method of claim 14 wherein swaging the collar and removing the removable portion of the elongated pin include engaging the third portion of the elongated pin with a first portion of an installation tool, engaging the collar with a second portion of the installation tool, and moving at least one of the first portion and the second portion axially relative to the other.
- [c18]            18.    The method of claim 14 wherein inserting the elongated pin includes inserting the elongated pin through a first hole in a first composite aircraft component and inserting the elongated pin through a second hole in a second composite aircraft component.
- [c19]            19.    The method of claim 14 wherein the elongated pin is elongated along an axis and wherein removing the third portion of the elongated pin includes applying a force to the third portion generally aligned with the axis.
- [c20]            20.    The method of claim 14 wherein swaging the collar includes applying an axial force and a radially inwardly directed force to the collar, without applying a torque to the collar.
- [c21]            21.    A method for sealably fastening aircraft components, comprising:  
                 inserting an elongated pin through a first hole in a first composite aircraft component and a second hole in a second composite aircraft component, with a head of the pin positioned against the first composite aircraft component, the first hole having a first diameter greater than a diameter of a first portion of the elongated pin received in the first hole, the second hole having a second diameter

greater than a diameter of a second portion of the elongated pin received in the second hole;

applying a flowable sealant to the elongated pin;

engaging a swaging tool with a third portion of the elongated pin, the second portion of the elongated pin being positioned between the first and third portions of the elongated pin;

swaging a collar to a helical groove of the elongated pin with the swaging tool so that the collar abuts against the second composite aircraft component, the helical groove being positioned between the third portion of the elongated pin and the second composite aircraft component;

breaking a connection located between the third portion of the elongated pin and the second portion of the elongated pin by applying an axial tension to the third portion while swaging the collar; and

removing the third portion of the elongated pin.

[c22]            22.    The method of claim 21 wherein swaging the collar and removing the removable portion of the elongated pin include engaging the third portion of the elongated pin with a first portion of the swaging tool, engaging the collar with a second portion of the swaging tool, and moving at least one of the first portion and the second portion axially relative to the other.

[c23]            23.    The method of claim 21, further comprising passing at least some of the flowable sealant along a helical path through the helical groove while swaging the collar to the helical groove.

[c24]            24.    The method of claim 21, further comprising passing the collar axially over the helical groove without rotating either the collar or the elongated pin, prior to swaging the collar.

[c25] 25. The method of claim 21 wherein swaging the collar includes applying an axial and radially inwardly directed force to the collar, without applying a torque to the collar.

[c26] 26. A fastening method, comprising:  
inserting an elongated member through a hole in at least one component, with a head of the elongated member positioned at least proximate to the at least one component;  
swaging a collar to a helical groove of the elongated member, with the at least one component positioned between the head and the collar, and with the collar positioned between the at least one component and a removable portion of the elongated member; and  
removing the removable portion of the elongated member.

[c27] 27. The method of claim 26 wherein removing the removable portion of the elongated member is performed during, after, or during and after swaging the collar.

[c28] 28. The method of claim 26, further comprising applying a liquid to the elongated member before swaging the collar, and swaging the collar without removing the liquid.

[c29] 29. The method of claim 26 wherein swaging the collar and removing the removable portion of the elongated member include engaging the removable portion of the elongated member with a first portion of an installation tool, engaging the collar with a second portion of the installation tool, and moving at least one of the first portion and the second portion axially relative to the other.

[c30] 30. The method of claim 26 wherein the elongated member is elongated along an axis and wherein removing the removable portion of the elongated

member includes applying a force to the removable portion generally aligned with the axis.

[c31] 31. The method of claim 26 wherein inserting the elongated member includes inserting the elongated member without a tool, and with the elongated member having a loose fit in the hole.

[c32] 32. The method of claim 26 wherein swaging the collar includes applying an axial force and a radially inwardly directed force to the collar, without applying a torque to the collar.

[c33] 33. The method of claim 26, further comprising passing the collar axially over the helical groove without rotating either the collar or the elongated member, prior to swaging the collar.

[c34] 34. A fastener system, comprising:  
a collar having an aperture; and  
an elongated member having a head portion and a shaft portion, the shaft portion being configured to be received in the aperture of the collar, the shaft portion including at least one helical thread, a tool engagement portion, and a frangible portion between the at least one helical thread and the tool engagement portion, the frangible portion being configured to break under an axial tension when a tool engages the tool engagement portion and swages the collar onto the at least one helical thread.

[c35] 35. The fastener system of claim 34, further comprising the tool.

[c36] 36. The fastener system of claim 34, further comprising the tool, and wherein the tool includes a first portion positioned to engage the tool engagement

portion and a second portion positioned to contact the collar, and wherein at least one of the first and second portions is movable relative to the other.

[c37] 37. The fastener system of claim 34 wherein the elongated member has a generally circular cross-section, and wherein the tool engagement portion includes at least one ridge extending circumferentially around the elongated member at a single axial location.

[c38] 38. The fastener system of claim 34 wherein the engagement portion includes a plurality of spaced apart rings extending circumferentially around the elongated member.

[c39] 39. The fastener system of claim 34 wherein the aperture of the collar is sized to slip axially over the at least one helical thread without rotating either the collar or the elongated member.

[c40] 40. A fastener system, comprising:  
a collar having an aperture;  
an elongated pin having a head portion and a shaft portion, the shaft portion being configured to be received in the aperture of the collar, the shaft portion including at least one helical thread, a plurality of axially spaced-apart, circumferential ridges, and a frangible portion between the at least one helical thread and the circumferential ridges, the frangible portion being configured to break under an axial tension high enough to allow the collar to be swaged onto the at least one helical thread; and  
an installation tool having a first portion positioned to engage the circumferential ridges, the installation tool having a second portion positioned to engage the collar, at least one of the first portion and the second portion being movable relative to the other to swage the



collar onto the at least one helical thread, and break the frangible portion.

[c41] 41. The system of claim 40 wherein the first portion of the installation tool includes a collet and the second portion includes an anvil having an axially extending aperture.

[c42] 42. A fastener system, comprising:  
first fastening means having an aperture; and  
second fastening means configured to be received in the aperture of the first fastening means, the second fastening means including at least one helical thread, a tool engagement portion, and a frangible portion between the at least one helical thread and the tool engagement portion, the frangible portion being configured to break under an axial tension when a tool engages the tool engagement portion and swages the first fastening means onto the at least one helical thread.

[c43] 43. The fastener system of claim 42, further comprising the tool, and wherein the tool includes a first portion positioned to engage the tool engagement portion and a second portion positioned to contact the first fastening means, and wherein at least one of the first and second portions is movable relative to the other.

[c44] 44. An aircraft, comprising:  
a first component having a first aperture;  
a second component having a second aperture coaxially aligned with the first aperture;  
an elongated member having a head portion positioned at least proximate to the first component, the elongated member further having a shaft

portion extending through the first and second apertures, the shaft portion including at least one helical thread, the shaft portion further including at least part of a frangible portion that has been broken under an axial, tensile force; and

a collar having an aperture into which the elongated member is received, the collar being swaged onto the at least one helical thread of the elongated member.

[c45] 45. The aircraft of claim 44 wherein at least one of the first and second components has a composite composition.

[c46] 46. The aircraft of claim 44 wherein the first and second components include wing panels.

[c47] 47. The aircraft of claim 44, further comprising a sealant disposed on the elongated member to seal a connection between the first and second components.

[c48] 48. An assembly of components formed by a process, comprising:  
inserting an elongated member through a first hole in a first component and a second hole in a second component, with a head of the elongated member positioned at least proximate to the first component;  
swaging a collar to a helical groove of the elongated member, with the first and second components positioned between the head and the collar, and with the collar positioned between the second component and a removable portion of the elongated member; and  
removing the removable portion of the elongated member by applying an axial tensile force to the removable portion to break a connection between the removable portion and a remainder of the elongated

member, the remainder including at least part of a frangible portion that has been broken under the axial, tensile force.

[c49]            49.    The assembly of claim 48 wherein removing the removable portion of the elongated member is performed during, after, or during and after swaging the collar.

[c50]            50.    The assembly of claim 48 wherein inserting the elongated member through the first hole includes inserting the elongated member so that a first portion of the elongated member aligned with and received by the first hole has a diameter less than a diameter of the first hole, and wherein inserting the elongated member through the second hole includes inserting the elongated member so that a second portion of the elongated member aligned with and received by the second hole has a diameter less than a diameter of the second hole.

[c51]            51.    The assembly of claim 48, further comprising applying a liquid to the elongated member before swaging the collar, and swaging the collar without removing the liquid.

[c52]            52.    The assembly of claim 48 wherein inserting the elongated member includes inserting the elongated member through a first hole in a first composite aircraft component and inserting the elongated member through a second hole in a second composite aircraft component.

[c53]            53.    The assembly of claim 48 wherein the elongated member is elongated along an axis and wherein removing the removable portion of the elongated member includes applying a force to the removable portion generally aligned with the axis.